

CLAIMS

1 1. A method for extracting data of interest from observed vector data, the method
2 comprising:

3 determining the projection of each vector in observed vector data onto a subspace as a
4 vector subtraction in an original coordinate system.

1 2. A method for processing a block of discrete data vectors to obtain a decomposition of the
2 data with respect to a correlation direction vector, the method comprising:

3 multiplying each data vector onto the correlation direction vector to determine a scalar
4 amplitude of each data vector in the direction of the correlation direction vector;

5 multiplying each scalar amplitude onto the correlation direction vector to determine a set
6 of scaled vectors; and

7 subtracting the scaled vectors from the data vectors.

1 3. In a filter, a method for processing a block of discrete data vectors to obtain a
2 decomposition of the data with respect to a correlation direction vector, the method comprising:

3 multiplying each data vector onto the correlation direction vector to determine a scalar
4 amplitude of each data vector in the direction of the correlation direction vector;

5 multiplying each scalar amplitude onto the correlation direction vector to determine a set
6 of scaled vectors; and

7 subtracting the scaled vectors from the data vectors.

1 4. A method for adaptively analyzing data, the data characterized by a set of data vectors, to
2 estimate that part of the data that best corresponds to a steering vector, the method comprising:

3 in a first analysis stage:

4 projecting each data vector onto the steering vector to form a set of inner products
5 that estimate the part of the data that best corresponds to the steering vector,

6 multiplying the inner products onto the steering vector to form a set of vector
7 estimates of that part of the data that best corresponds to the steering vector,

8 subtracting the vector estimates from the corresponding data vectors to obtain a
9 projection of the data onto the nullspace of the steering vector; and

10 in at least one adaptive analysis stage:
11 calculating a correlation direction vector of the current adaptive stage between the
12 corresponding inner products and vector differences of an immediately prior
13 analysis stage;
14 forming inner products of the current stage by projecting each vector difference of
15 the immediately prior analysis stage onto the correlation direction vector of the
16 current stage;
17 forming scaled vectors of the current stage by multiplying the inner products of the
18 current stage onto the correlation direction vector of the current stage;
19 forming the projection of the prior stage vector differences onto the nullspace of the
20 correlation direction vector of the current stage by subtracting each scaled
21 vector of the current stage from the corresponding projection of the prior stage.

1 5. A method for adaptively analyzing an observed signal, the signal characterized by a set of
2 data vectors, to estimate that part of the signal that best corresponds to a steering vector, the
3 method comprising:

4 in a first analysis stage:
5 projecting each data vector onto the steering vector to form a set of inner products
6 that estimate the part of the data that best corresponds to the steering vector,
7 multiplying the inner products onto the steering vector to form a set of vector
8 estimates of that part of the data that best corresponds to the steering vector,
9 subtracting the vector estimates from the corresponding data vectors to obtain a
10 projection of the data onto the nullspace of the steering vector; and

11 in at least one adaptive analysis stage:
12 calculating a correlation direction vector of the current adaptive stage between the
13 corresponding inner products and vector differences of an immediately prior
14 analysis stage;
15 forming inner products of the current stage by projecting each vector difference of
16 the immediately prior analysis stage onto the correlation direction vector of the
17 current stage;
18 forming scaled vectors of the current stage by multiplying the inner products of the
19 current stage onto the correlation direction vector of the current stage;

20 forming the projection of the prior stage vector differences onto the nullspace of the
21 correlation direction vector of the current stage by subtracting each scaled
22 vector of the current stage from the corresponding projection of the prior stage.

23 6. A method for adaptively analyzing discrete data, the data characterized by a vector data
24 set and a scalar data set, the sets having a common index, to obtain a decomposition of the data
25 based on correlation between the sets, the method comprising
26 in a first stage:

27 forming a first stage correlation direction vector between corresponding elements of
28 the vector data set and the scalar data set;
29 forming a set of first stage inner products between the vector data set and the first
30 stage correlation direction vector;
31 forming a set of first stage scaled direction vectors between the scalar data set and
32 the first stage correlation direction vector;
33 forming a set of first stage vector differences between the corresponding elements of
34 the set of first stage scaled direction vectors and the vector data set; and

35 in each of zero or more subsequent stages:

36 receiving the set of inner products and the set of vector differences of the
37 immediately prior stage as inputs to the current stage;
38 forming a current stage correlation direction vector between corresponding elements
39 of the sets of inner product and vector difference current stage inputs;
40 forming a set of current stage inner products between the set of current stage vector
41 difference inputs and the current stage correlation direction vector;
42 forming a set of current stage scaled direction vectors between the set of inner
43 product current stage inputs and the current stage correlation direction vector;
44 forming a set of current stage vector differences between the corresponding elements
45 of the set of current stage scaled direction vectors and the set of current stage
46 vector difference inputs.

1 7. An analysis chain for a multistage adaptive filter, the analysis chain comprising:
2 a non-adaptive analysis stage, comprising:
3 a first inner product logic device operative:
4 to receive a set of data vectors and a steering vector, and

5 to form a first set of inner products of the steering vector and each data vector,
6 and
7 a first vector scaling logic device:
8 in communication with the first inner product logic device, and
9 operative:
10 to receive the steering vector and the first set of inner products, and
11 to form a first set of scaled direction vectors of the steering vector and
12 each inner product of the first set of inner products, and
13 a first vector difference logic device:
14 in communication with the first vector scaling logic device, and
15 operative:
16 to receive the set of data vectors and the first set of scaled vectors, and
17 to form a first set of vector differences between corresponding elements of
18 the set of data vectors and the first set of scaled vectors; and
19 at least one adaptive analysis stage comprising:
20 a correlation direction vector logic device:
21 in communication with the immediately prior stage, and
22 operative:
23 to receive a set of vector differences of the immediately prior stage and a
24 set of inner products of the immediately prior stage, and
25 to form a current stage correlation direction vector between the vector
26 differences of the immediately prior stage and the corresponding
27 inner products of the immediately prior stage; and
28 an adaptive stage inner product logic device:
29 in communication with the immediately prior stage and the adaptive stage
30 correlation direction vector logic device of the current stage, and
31 operative:
32 to receive the set of vector differences of the immediately prior stage and
33 the current stage correlation direction vector, and
34 to form a current stage set of inner products of each vector difference of
35 the immediately prior stage and the current stage correlation direction
36 vector; and
37 an adaptive stage vector scaling logic device:

38 in communication with the correlation direction vector logic device of the
39 current stage and the inner product device of the current stage, and
40 operative:

41 to receive the set of inner products of the current stage and the correlation
42 direction vector of the current stage, and

43 to form a current stage set of scaled direction vectors of each inner product
44 of the set of inner products of the current stage and the correlation
45 direction vector of the current stage; and

46 an adaptive stage vector difference logic device:

47 in communication with the vector difference logic device of the immediately
48 prior stage and the vector scaling logic device of the current stage, and
49 operative:

50 to receive the set of vector differences of the immediately prior stage and
51 the set of scaled vectors of the current stage, and
52 to form a current stage set of vector differences between corresponding
53 elements of the set of vector differences of the immediately prior
54 stage and the set of scaled direction vectors of the current stage.

1 8. A method for adaptively analyzing an observed signal, the signal characterized by
2 discrete data, the data characterized by a vector data set and a scalar data set, the sets having a
3 common index, to obtain a decomposition of the data based on correlation between the sets, the
4 method comprising

5 in a first stage:

6 forming a first stage correlation direction vector between corresponding elements of
7 the vector data set and the scalar data set;

8 forming a set of first stage inner products between the vector data set and the first
9 stage correlation direction vector;

10 forming a set of first stage scaled direction vectors between the scalar data set and
11 the first stage correlation direction vector;

12 forming a set of first stage vector differences between the corresponding elements of
13 the set of first stage scaled direction vectors and the vector data set; and

14 in each of zero or more subsequent stages:

15 receiving the set of inner products and the set of vector differences of the
16 immediately prior stage as inputs to the current stage;

17 forming a current stage correlation direction vector between corresponding elements
18 of the sets of inner product and vector difference current stage inputs;
19 forming a set of current stage inner products between the set of current stage vector
20 difference inputs and the current stage correlation direction vector;
21 forming a set of current stage scaled direction vectors between the set of inner
22 product current stage inputs and the current stage correlation direction vector;
23 forming a set of current stage vector differences between the corresponding elements
24 of the set of current stage scaled direction vectors and the set of current stage
25 vector difference inputs.

1 9. An adaptive stage of an analysis chain for a multistage adaptive filter, the adaptive stage
2 comprising:

3 a correlation direction vector logic device:

4 in communication with the immediately prior stage, and
5 operative:

6 to receive a set of vector differences of the immediately prior stage and a
7 set of inner products of the immediately prior stage, and

8 to form a current stage correlation direction vector between the vector
9 differences of the immediately prior stage and the corresponding
10 inner products of the immediately prior stage; and

11 an adaptive stage inner product logic device:

12 in communication with the immediately prior stage and the adaptive stage
13 correlation direction vector logic device of the current stage, and

14 operative:

15 to receive the set of vector differences of the immediately prior stage and
16 the current stage correlation direction vector, and

17 to form a current stage set of inner products of each vector difference of
18 the immediately prior stage and the current stage correlation direction
19 vector; and

20 an adaptive stage vector scaling logic device:

21 in communication with the correlation direction vector logic device of the
22 current stage and the inner product device of the current stage, and

23 operative:

24 to receive the set of inner products of the current stage and the correlation
25 direction vector of the current stage, and
26 to form a current stage set of scaled direction vectors of each inner product
27 of the set of inner products of the current stage and the correlation
28 direction vector of the current stage; and
29 an adaptive stage vector difference logic device:
30 in communication with the vector difference logic device of the immediately prior
31 stage and the vector scaling logic device of the current stage, and
32 operative:
33 to receive the set of vector differences of the immediately prior stage and
34 the set of scaled vectors of the current stage, and
35 to form a current stage set of vector differences between corresponding
36 elements of the set of vector differences of the immediately prior
37 stage and the set of scaled direction vectors of the current stage.